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Feed particle size directly impacts the manner in which chickens utilize nutrients in their diet, both in laying hens and broilers

The coffee crisis brought widespread unemployment, poverty and hunger to parts of Nicaragua. In some regions, 33% of the area's children suffer malnutrition and child mortality claims ten out of every thousand children. Partially, in response to the coffee crisis, there is interest in promoting the poultry industry in Nicaragua, and international aid agencies are assisting Nicaraguan farmers with poultry projects. For example, the Wisconsin/Nicaragua Partners of the Americas, Inc. is currently managing a poultry project in Nicaragua called Gallinas de Patio, or backyard chickens. The project provides material and technical assistance to Nicaraguan families, enabling them to successfully raise and sustain a flock of chickens and providing a renewable source of dietary protein.

Poultry consumption per capita in Central America is increasing due to the declining relative prices of chicken compared with other meats. Imported maize is the most common grain used in preparing poultry rations in Central America. However, there is interest in substituting sorghum for maize in poultry rations.

INTSORMIL in Central America

The Central American INTSORMIL project is dedicated to the promotion of sorghum as a feed for the burgeoning poultry industry. Poultry nutrition, for both broilers and egg production, is a major subject

Gallo Pinto in Nicaragua

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of INTSORMIL research. The Central American countries of El Salvador, Honduras and Nicaragua together have about 167,000 ha planted to sorghum. Sorghum is an important crop in Nicaragua, grown largely to feed the thriving livestock industry, but it is also cultivated for food security along with drought-sensitive early maize in marginal production regions. During the dry season, sorghum serves an important livestock feed in the form of dried stalks and leaves. Depending on the rainfall and agronomic practices, between 2 and 3 t of stover is produced by sorghum. There is also a traditional practice, which is the cultivation of "*guate",* a fodder crop of sorghum for dry-season feeding of livestock.

About 75,000 tons of sorghum grain are produced each year from 47,000 hectares in Nicaragua. Thus, sorghum grain is readily available for use in poultry rations as a substitute for maize in Nicaragua and other Central American nations. However, sorghum producers often face heavy discounts for their grain compared to imported maize due to a conception that sorghum is not as nutritional a poultry feed as maize. To overcome the misconceptions poultry producers have regarding sorghum grain as a poultry feed, INTSORMIL sponsored activities were conducted in Nicaragua by Kansas State University (KSU) and University of Nebraska scientists in collaboration with Nicaraguan scientists of the Universidad Nacional Agraria (UNA) and the Nicaraguan Grain Sorghum Producers Association (ANPROSOR) in Managua, Nicaragua. The activity was conducted by M. C. Herrera and G. M. Herrera, UNA students for their BSc. theses and was guided by Carolina Feoli, a Costa Rican graduate student advised by KSU animal nutritionist, Joe Hancock, Steve Mason, Central America INTSORMIL Regional Coordinator, University of Nebraska and their Nicaraguan collaborators F. Vargas (ANPROSOR) and Prof. M. Rios (UNA). The activity was targeted towards increasing the value of sorghum as feed for broiler chickens. The objective of the study was to determine the nutritional value of imported maize vs locally produced sorghum grain when ground through different screen sizes in a hammermill.

Impact of Feed Particle Sizes on Poultry Nutrition

Feed particles impact in two areas of poultry feeding. First, broilers and layers eat using their own sensory perception of the food which includes preference for certain sized particles. Second, particle size impacts directly the manner in which chickens utilize the nutrients in their diet, both in the case of laying hens and broilers. Rate of particle breakdown in the proximal small intestine is affected by grain particle size. Data from KSU suggests that particle size of the feeding ration is of major importance as regards to nutritional value to the broilers, and that the feeding value of U.S. sorghum is comparable to U.S. maize when ground to an appropriate 5 mm or less particle size.

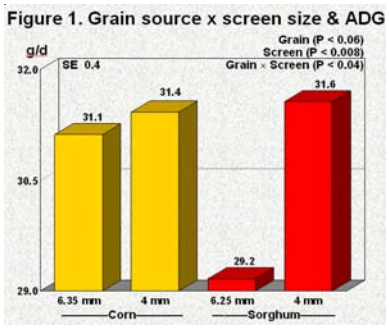
Hammermill screens for producing various grain particle sizes (upper left), whole maize and sorghum kernels (upper right) and ground sorghum (two particle sizes) (lower right).

Nicaraguan Particle Size Study

In the Nicaraguan study, seven hundred twenty 1-d-old broiler chicks (Cobb x Cobb with an average initial body weight of 43 g) were used in a 14-d growth assay to determine the nutritional value of maize (No. 2 yellow maize imported from the United States) vs sorghum grain (Pinolero-1, a locally adapted variety with white seeds). The maize and sorghum were ground through a hammermill with screens having 6.3 vs 4 mm diameter openings.

Mixing poultry rations in a Nicaraguan mill

Effect of Particle Size on Broiler Nutrition



Chicks had greater average daily gain (ADG) when the cereal grains were ground through the smaller screen size and this effect was most pronounced for chicks fed diets with sorghum. There were no effects of grain source or screen size on average daily feed intake (ADFI) but gain to feed ratio (G:F) was markedly improved when sorghum grain was ground through the screen with smaller openings. For the diets with maize and sorghum ground through 6.3 mm screens average daily gain was 31.1 and 29.2 g/d respectively, while for 4 mm maize and sorghum particles gain was 31.4 and 31.6 g/d respectively (see figure).

Gain:feed ratio for 6.3 mm maize and sorghum was 0.66 and 0.59 g/d respectively while at 4 mm maize was 0.62 while sorghum was 0.66 g/d.

Baby chicks in the study at waterer (L) and older broilers feeding on sorghum (R)

Implications for Nicaraguan Poultry Producers

Particle size of sorghum had a distinct effect on the average daily gain and the Gain:Feed intake. At 4 mm feed particle size, daily gain on sorghum was slightly superior to that of maize and the Gain:Feed was equal to that of maize. Thus we can conclude that when ground to an appropriate particle size, domestically produced Nicaraguan sorghum grain was equal to imported maize in nutritional value for broiler chicks.

INTSORMIL scientists recommend sorghum as a substitute for maize in the burgeoning poultry industry in Central America because sorghum is more productive than maize under dry growing conditions and is locally grown.

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